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HOME Canning

OF FRUITS
VEGETABLES
and MEATS

U. S. DEPARTMENT
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HOME CANNING OF FRUITS, VEGETABLES, AND MEATS

by

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CANNING, ECONOMICAL WAY TO PRESERVE FOOD

CANNING is a method of using heat and airtight containers to preserve food as nearly as possible in the condition in which it is served when freshly cooked. It is a desirable and economical method of preserving many foods so that their use can be distributed over seasons and to places where they are not available fresh. Canned foods thus make possible a better-balanced and more-varied diet throughout the year.

The method of canning foods affects the vitamin content to some extent. With the possible exception of vitamin C there may be no serious loss during the canning process, though of course when foods are removed from the cans and reheated before serving, there may be additional loss of vitamins. In order to preserve all the vitamins possible in canned products, emphasis is placed throughout this bulletin on canning foods very soon after they are gathered and on carrying every step of the process through rapidly. Precooking foods for a short time, packing them hot, and processing them in the containers help to preserve the vitamin value.

None of the minerals in foods need be lost in canning, providing the liquid in which they are precooked is used to fill up the containers and provided the entire contents of the can is served.

A canning budget prepared at the beginning of the season will indicate what quantities of different canned foods are needed by the family. In making such a budget, consider the number of persons in the family, the length of time that fresh foods are out of season, and what foods are available for canning, as well as the cost of equipment and containers, and the value of the time of the persons doing the work. Assistance in planning a canning budget suitable to the locality

¹ Deceased.

and adapted to the nutritional requirements of the family may be obtained from the State college of agriculture.

Correct Processing for Canning Success

Successful canning is based on an understanding of the important causes for the rapid spoilage of fresh foods and on a knowledge of the methods by which this spoilage may be prevented. The two agents that cause food spoilage are enzymes and micro-organisms, including bacteria, yeasts, and molds.

All fresh fruits, vegetables, and meats contain substances called enzymes. Up to a certain point these enzymes bring about desirable changes in foods. They cause fruits and vegetables to ripen normally and the tissues of meats to become more tender as they are held in storage; but if allowed to go on unchecked, enzymes hasten the decay of foods. The low temperatures of cold storage retard the action of enzymes, and the heat of cooking or canning destroys them entirely.

To prevent undesirable changes due to enzymes, fruits and vegetables should be canned as soon as possible after they are gathered. "Two hours from garden to can" is a good rule. If they must be held they should be kept in small lots in a cool, well-ventilated place. Meats should be refrigerated at 30° to 32° F. if they are to be held for several days.

The second and more important cause of food spoilage is the action of three groups of minute organisms that are present in the air, soil, water, and, in fact, on everything. They are yeasts, molds, and bacteria.

If all micro-organisms in food are killed and it is sealed steaming hot in sterile airtight containers, it is said to be sterilized. The application of heat to foods during canning in order to kill micro-organisms is called processing. Food spoils when it comes in contact with unheated air because of the bacteria, yeasts, and molds the air contains. For successful canning, it is not enough just to destroy the micro-organisms. After being processed, the food must be protected from the air by a hermetic seal.

Yeasts and molds are easily destroyed by heat in canning. Temperatures below the boiling point of water (from about 150° to 180° F. for varying periods of time) are effective in destroying them. Yeasts rarely cause spoilage in canned foods, and molds never do unless the container holding the food is faulty and permits the organisms to gain entrance from the air.

In killing bacteria by heat, both the degree of temperature and the

length of time it is to be applied must be considered. A very high temperature may produce a sterile canned product that will keep well, but this may be at too great a sacrifice of flavor and texture. Therefore the temperature applied should ordinarily be the lowest and the period of time the shortest necessary to accomplish the desired result. This may not in every case actually sterilize the food, but it does give "effective sterilization," by destroying the organisms that are likely to grow and cause spoilage when the food is stored under average conditions.

While bacteria are growing actively they are easily destroyed at the temperature of boiling water (212° F.). But some kinds of bacteria go through a dormant or spore form in the course of their life cycle and in that stage are very resistant to heat. It may take 6 hours or more at boiling temperature (212°) to kill these spores, but at 240°, the temperature obtained in the steam pressure canner, they may be destroyed in 30 minutes.

Whether foods are acid or nonacid also makes a difference in the rate at which bacteria may be killed. When the foods are definitely acid, as, for example, fruits and tomatoes, all forms of bacteria are killed within a reasonable time at the temperature of boiling water. With the nonacid foods, such as meats and corn, peas, beans, and practically all vegetables except tomatoes, these heat-resistant bacteria can be killed with speed and surety only at the high temperatures obtainable in the steam pressure canner.

The types of bacteria vary with different foods, also with the year, the locality, and the conditions of production. For example, some of the most heat-resistant forms of bacteria are in the soil. Consequently a low-growing vegetable like spinach may be heavily contaminated and the fuzzy coating on snap beans may shelter such bacteria and make them difficult to remove.

Bacteria may cause the following types of spoilage

Dangerous in canned foods.

bacteria

Fermentation is one type of spoilage caused by bacteria. During fermentation, acid and gas are produced, causing the food to become sour or "cheesy." Tin cans may bulge or seals on jars may be broken by accumulated gas.

Flat-sour spoilage is caused by bacteria that produce acid without gas. They grow best at temperatures about 130° to 140° F. and sometimes cause spoilage in canned foods not properly cooled after processing or held at too-high storage temperatures. Corn, peas, and snap beans are subject to flat-sour spoilage.

Another type of bacteria causes putrefaction in canned food. The growth of putrefactive bacteria is marked by gas production, a bad odor, and the softening and darkening of canned food. Putrefaction

usually occurs in foods low in acidity, such as meats, peas, and corn.

Botulinus When the spores of botulinus bacteria are not destroyed in the canning process they may grow later
spoilage and produce a toxin in the food. Since a number

of cases of botulinus poisoning have been traced to inadequately processed foods, the botulinus bacteria have been studied in order to find the temperature and conditions necessary for destroying them. They will not grow in salt solutions when more than 9 percent of salt is present. They are destroyed by processing at 212° F. if the solution is sufficiently acid. With beans, corn, peas, and other nonacid vegetables and meats they may not be killed at the temperature of boiling water (212° F.) unless the food is heated for 6 to 10 hours or even longer, but the time may be decreased very much if the higher temperature of the steam pressure canner is used.

Since various agents, such as birds and winds blowing dust, may carry bacteria from one area to another, it cannot be assumed that any particular locality is free from botulinus bacteria. The directions in this bulletin for handling the various fruits, vegetables, and meats have been prepared as a safeguard against spoilage due to this dangerous type of bacteria.

Is Food Acid or Nonacid?

For purposes of canning, foods are considered in two groups according to the quantity of free acid they contain. The acid foods are fruits, tomatoes, pickled beets, ripe pimientos, and rhubarb. The nonacid foods include all other vegetables, such as asparagus, peas, beans, and corn, and also meats and poultry.

The acid foods are processed at or near the temperature of boiling water (212° F.) in a boiling-water bath, or in a steamer without pressure, or in an oven. The acid products may also be canned from the open kettle.

Nonacid foods must be processed in a steam pressure canner at temperatures of 240° to 250° F. obtained by applying 10 to 15 pounds of steam pressure.

The addition of small quantities of an acid, such as vinegar or lemon juice to a nonacid vegetable or meat does not change the acidity of the food enough to permit processing in the boiling-water bath. This can be done only if enough acid is added to pickle the food. For example, beets are a nonacid vegetable and need to be processed under steam pressure, but when they are pickled in vinegar they may be handled as an acid product in the boiling-water bath.

The use of chemical preservatives, such as salicylic acid, sodium benzoate, and "canning powders," should be avoided in home canning any kind of food. These chemicals vary in their effects on the human body, some being more harmful than others. Therefore

the safe way for the home canner is to process foods adequately with heat and not to use chemical preservatives.

CANNING EQUIPMENT AND METHODS

Prepare for the canning season by checking over in advance the equipment and materials that will be needed. This may prevent delays when the food is ready to can.

Boiling-Water Bath—for Acid Foods

For processing acid foods, the water bath is the most generally satisfactory method in the home. If water is boiled in an open vessel or in one on which the top is not clamped down tightly, the temperature reached is never higher than the boiling point of water. All additional heat applied goes to changing the water to steam, and the water boils away. Therefore the temperature of the food in the cans surrounded by the boiling water does not go higher than that of the water.

Moreover, the boiling point of water is not always the same. It depends upon atmospheric pressure, which changes with the altitude. At sea level, the boiling point of water is 212° F., and it decreases as the altitude increases. Allowance should be made for this in home canning. In this bulletin the directions for processing in boiling water are based on the boiling point at altitudes of 1,000 feet or less. For altitudes above 1,000 feet the length of processing should be increased 20 percent for each additional 1,000 feet.

<i>Altitude (feet)</i>	<i>Temperature of boiling water</i>		<i>Altitude (feet)</i>	<i>Temperature of boiling water</i>	
	<i>° F.</i>	<i>° C.</i>		<i>° F.</i>	<i>° C.</i>
Sea level.....	212	100	5,225.....	202	94
1,025.....	210	99	6,304.....	200	93
2,063.....	208	98	7,381.....	198	92
3,115.....	206	97	8,481.....	196	91
4,169.....	204	95	9,031.....	195	90

A water-bath canner may be made from a wash boiler, a bucket, or any vessel that has a tight cover and is large enough to hold a convenient number of cans of food and to permit covering them with 1 to 2 inches of water. It should be fitted with a rack to hold the jars. A wire basket for this purpose can be made by a tinner at small cost or at home from wire-mesh fencing, or it may be purchased.

In processing fruits and other acid foods in the water bath, be sure that the jars or cans are far enough apart and that the rack on which

they are supported is so arranged that the water can circulate freely under and around them.

Have the water in the canner boiling before putting in the cans of food. In order to keep the glass jars from breaking they must be preheated in water or filled with hot food.

When all the containers are in the canner, see that the water comes over the tops at least 1 or 2 inches. Add more boiling water as needed to keep this level.

Count time as soon as the water begins to boil vigorously. Keep the bath boiling constantly during all of the processing period.

As soon as the processing time is up, remove the glass jars from the water one at a time. Jars should be tightly sealed at this time if necessary. Methods used for sealing the different kinds of jars are described on pages 11 and 12. Tin cans are sealed before they are placed in the water bath and need no further adjustment.

Steam Pressure Canner—for Nonacid Foods

A steam pressure canner is required for processing meats, practically all vegetables except tomatoes, and other nonacid foods. It is not safe to can such foods at home unless a pressure canner is available.

Since pressure canners are made of materials much needed in the war effort, not enough of these canners are now being manufactured to supply the demand. It will help in meeting this situation, for owners of pressure canners to share their equipment in a neighborhood. It is worth while to find out whether community canning centers are set up within the community. At these centers resources are pooled, and homemakers with less experience in canning may have helpful guidance.

Share the canners

If no pressure cooker is available, nonacid foods should be preserved in other safe ways. Ways of preserving vegetables and fruits are drying, pickling, quick freezing, storing. Meats may be cured or frozen.

The pressure canner is especially designed to heat foods to higher temperatures than can be reached in a boiling-water bath or an ordinary steamer. Foods cannot be heated beyond the boiling point of water at a particular altitude unless the vessel has a tight-fitting cover clamped down so the steam is held in under pressure. It is desirable to have a thermometer set into the top so that pressure can be checked against temperature. Pressure canners of usual household sizes are not manufactured with thermometers, but on canners of larger size, as 40-quart or more capacity, a reliable thermometer can be inserted for a few dollars' additional cost.

If nonacid foods are being canned for sale the pressure canners should be equipped with thermometers to make certain that the

processing will be adequate. Pressure gages may become inaccurate after a period of use. Those that have the indicator soldered or otherwise attached permanently to the stem will remain in good condition longer than gages in which the indicator is held in place by friction only.

The size of the pressure canner should be suitable to the kind of containers and the probable number to be handled at one time. For home use, pressure canners of from 18- to 21-quart capacity have been found most satisfactory. While larger canners are available on the market, they are too heavy and too awkward for the homemaker to handle. The smaller steam pressure outfits, of 10- to 12-quart capacity, are intended for cooking rather than canning. They hold only a few cans at a time, and it is almost impossible to operate them so that the pressure does not fluctuate during the processing period. If home canning is to be done regularly, therefore, it pays to have a good-sized pressure canner in perfect working order (table 1).

TABLE 1.—Approximate capacity of steam pressure canners of various sizes

Size of canner (quarts)	Net weight of canner	Capacity			
		No. 2 tin cans	No. 3 tin cans	Pint glass jars	Quart glass jars
	<i>Pounds</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>
18-----	18	14	8	8	5
25-----	27	16	10	18	7
30-----	35	19	12	20	8
40-----	50	25	16	24	16

Since the temperature obtained in the steam pressure canner, as well as in the boiling water bath, is affected by altitude, allowance for this must be made in home canning. In this bulletin processing periods are based on the pressure-temperature figures at sea level. At altitudes over 2,000 feet, add 1 pound pressure for each additional 2,000 feet (table 2).

TABLE 2.—Corresponding pressure and temperature figures, under standard conditions at sea level

Steam pressure (pounds)	Temperature		Steam pressure (pounds)	Temperature	
	° F.	° C.		° F.	° C.
5-----	228	109	20-----	259	126
10-----	240	115	25-----	267	131
15-----	250	121			

In operating and caring for a pressure canner Using the pres- follow the directions of the manufacturer. Certain sure canner points need special attention.

Pour boiling water into the canner to a depth of about 1 inch or until the level is just below the rack that holds the containers. Add more water up to this level after processing each load, so that the canner will not boil dry and be damaged.

Allow space between the containers for the circulation of steam. Tin cans may be arranged in several tiers by using a wire rack or metal strips to keep the cans apart and permit the circulation of steam.

After the canner is loaded, adjust the cover and fasten it securely. If there are several clamps fasten moderately tight those opposite each other, a pair at a time; then go back over the whole set and tighten each pair.

See that no steam escapes anywhere except at the pet cock.

Allow the pet cock to remain open until the steam escapes from it in a steady stream for 4 to 7 minutes, indicating that no air remains inside. Otherwise the pressure will be partly due to air, and the temperature will fall short of the required degree. Then close the pet cock and allow the pressure to rise until the gage registers the desired point.

Count time from the moment the desired pressure is reached. Keep close watch on the canner while in use. Regulate the heat carefully so as to maintain a uniform pressure during the processing period, and do not allow drafts to blow on the canner. Fluctuations in pressure, as from 10 pounds to 15 pounds and down again, should always be avoided. This may cause loss of liquid from glass jars. It is especially important to keep the pressure from going so high that the safety valve releases the steam suddenly, nor should the steam be allowed to escape suddenly by opening the pet cock.

At the end of the processing period remove the canner from the fire. When using glass jars or No. 3 or larger tin cans, allow the canner to cool until the gage registers zero before opening the pet cock, and then open gradually. Remove glass jars one at a time and seal rubber ring jars tightly at once. Self-sealing types of jars should have no further adjustment. Tightening at this time may break the seal. Adjustments vary with the types of jar (p. 12). If liquid has been lost, do not open the jars to add more.

Do not hasten the cooling of a pressure canner by applying cold water or wet cloths, or by placing it on a cold surface. To do so may crack the canner.

If tin cans smaller than No. 3 are used, open the pet cock gradually at the end of processing and allow the steam to escape slowly.

When opening the pressure canner, tilt the cover so that the steam emerges away from the operator.

Wash the pressure canner after it has been used.

Care of the canner Keep the surfaces that form the closure between pot and cover clean. This will reduce the tendency of the cover to stick. Take care not to dent or roughen these surfaces. Do not use an abrasive on them. New pressure canners sometimes leak steam slightly at this junction, but after being heated several times the surfaces should adjust to each other to make the closure tight.

Keep the safety valve in good working condition. If it is a valve of the ball and socket type, wash it each day after using. A safety valve that fails to operate properly may cause an accident.

Use a toothpick to keep the opening of the pressure gage clean. Do not immerse the pressure gage in water.

Since the pressure gage is the only guide to the temperature reached inside most home canners, it is essential that pressure gages register accurately. They sometimes get out of order, hence should be checked at the beginning of the canning season or more often if the canner is in constant use. Simple ways to do this are with a master pressure gage, or with a maximum thermometer of suitable range 100° to 300° F.

To make the test with a master pressure gage, first unscrew the pet cock or safety valve from the lid of the pressure canner and replace it with the master gage. Next pour water into the canner and heat (p. 8) running the pressure up gradually. Compare the two gages. If the difference is 2 pounds or less, tag the canner with the number of pounds its gage must register when processing food in order to correspond to 5, 10, or 15 pounds on the master gage. If the difference is more than 2 pounds get a new gage. After the test is over, reset the pet cock or safety valve with a steamtight closure by applying a paste of litharge and glycerin, such as plumbers use, to the threads of the stem before screwing it into the lid.

Details of testing pressure gages with a maximum thermometer can be obtained on request.

Manufacturers will check the gages if they are removed and returned to the factory where they were made. It is also possible in some States to get the State agricultural college to check gages.

Steamers and Ovens

In canning acid foods, heat may also be applied in a steamer or an oven.

In the steamer, where the steam circulates but is not held under pressure, the temperature surrounding the cans of food may be the same as in the boiling-water bath. It is necessary, however, to maintain a good circulation of steam if this method is to be efficient

in processing. In actual practice the steamer is often used without good circulation of steam and for that reason is unsatisfactory. When the steamer is properly operated, the processing periods for acid foods are the same as in the water bath.

Oven canning refers to the processing of food in glass jars in an oven. The temperatures generally used for the oven are from 250° to 275° F. Even with the oven at these or higher temperatures the food being processed inside the jars is little if any hotter than boiling water. For as steam forms in the jars it forces its way out, and the temperature remains near 212° F. Glass jars using rubber rings can be only partially sealed for oven processing. Otherwise, the accumulated steam would break the seals or the jars themselves. When caps of the vacuum or self-sealing types are used, screw the bands on tightly before processing. Tin cans cannot be used in oven canning, because of the danger of spreading or bursting the seams.

Since the temperature of the food in oven canning is only about 212° F., this method is not safe for nonacid foods. Oven canning is used successfully for some acid products such as the small fruits. Peaches, pears, and apricots, especially when packed without pre-cooking, are likely to develop a brownish discoloration after oven canning. Another disadvantage of oven canning is that some of the liquid bubbles out of the jars and is lost.

Processing periods in the oven are about half as long again as in the boiling-water bath because the air in the oven is not so good a conductor of heat as is water. However, if the food is precooked and packed hot into the jars, the processing period in the oven may be shortened somewhat. Even so, it is still longer than that in the boiling-water bath. For example, peaches packed hot require 15 minutes processing in the water bath, but in the oven, 25 minutes.

The Open Kettle

In the so-called open-kettle method fruits or tomatoes are cooked directly in an open vessel to kill the bacteria. This cooking takes the place of both precooking and processing in the other methods.

Water or sirup is added if required, and the food is boiled for several minutes or until tender. It is then quickly filled into sterilized jars and each one is sealed immediately. The jars should be filled to the top to drive out the air.

In this open-kettle method though the food heats through evenly and quickly the temperature does not go above the boiling point of water, except as it may be slightly raised by added sugar or soluble materials in the juices. Therefore this method can be used only for fruits and tomatoes canned in glass. Disadvantages of the open-kettle method are the necessity for sterilizing jars and caps before using (p. 12) and the chance of contaminating them again during

filling. Furthermore, there is always danger that air containing micro-organisms will be incorporated when jars are filled in this way. If they are sealed while boiling hot, however, this danger is in part avoided. Tin cans should not be used for open-kettle canning of fruits and tomatoes because the lids cannot be sterilized before being sealed on the can (p. 16). This method cannot be used safely for canning nonacid foods.

Glass Jars and Bottles

Glass jars for home canning are being made in **Wartime types** quart and larger sizes only, as a wartime economy measure. By discontinuing small jars it is possible to reduce the amount of rubber and metal used in home canning.

Mason jars have several kinds of tops: (1) A one-piece cap lined with porcelain; equipped with a rubber gasket between cap and shoulder of the jar. This is called a shoulder rubber. (2) A glass cap with rubber ring that fits between the glass cap and the jar top, both of which are held in place with a metal screw band. This ring is called a top rubber. (3) A metal disk with a flowed-on gasket, the disk is held on the jar by a metal screw band. Types 2 and 3 are sometimes called vacuum or self-sealing types.

Another type of jar known as lightning-type has an all-glass top. This uses a shoulder rubber ring, and the top is held in place with a wire clamp. Some lightning-type jars may still be bought, but manufacture of this type is being discontinued for the duration.

Home canning jars may be used repeatedly by

To use jars providing new rubbers, and in some cases new caps.

on hand If pint or quart jars that held mayonnaise, peanut butter, or other commercial products are to be used

in home canning, be sure that the jar mouth is so threaded that it will take one of the standard tops which will seal air tight.

Jars in which fruits and vegetables are packed now by commercial methods cannot be reused for home canning because the closures require special machinery not available in the home.

A word of warning: Check the types of jars on hand and see that any new lids or rubber rings purchased will fit. See that the rubber ring is right for the particular type of top, and that the screw band is exactly the right depth to fit jar and lid.

Rubber rings are highly important to keep food

Rubber rings from spoiling. Rings should be of good quality to withstand the heat of processing. The simplest test is: Double the ring together and press the fold with the fingers. The rubber should not crack when this is done. A good rubber ring should also stretch to twice its length and return without changing shape.

Rubbers of especially good quality may occasionally be reused with safety. They should meet the tests described in the preceding paragraph. Also, each rubber considered for reuse should be examined closely and used only if it shows no impressions from contact with jar and top.

Since it is important to use metals economically, **Screw bands** buy only as many screw bands as are needed. If canning is done on more than one day, screw bands on a set of finished jars may be removed and used in canning another set. *Do not, however, remove screw bands from any jar of canned food until the jar has completely cooled. Do not put away any canned food with screw band in place.*

Examine glass jars and caps carefully before **Getting jars ready to use** using, to make certain that they are in good condition. Discard any jars or caps that have cracks, chips, or dents. Anything that prevents an air-tight seal may cause food to spoil. Jar rims should be smooth with no cracks or chipping. If lightning-type jars are used, they may need some tightening of wire clamps. A wire clamp that has loosened in use may be tightened by removing the top wire, bending it down in the middle, and then bending the sides inward, if necessary, to fit the jar.

Wash the jars and tops in hot soapy water and rinse. Place them in a pan of warm water with a rack or cloth in the bottom to prevent bumping. Bring to the boiling point and keep hot until required. Jars and tops for open-kettle canning should be sterilized by 15 to 20 minutes' boiling. When jars are packed with food and then processed they do not need to be sterilized first, but they should be clean and hot when filled. Prepare jar caps that have a sealing composition by pouring boiling water over them. Allow them to stand until used. Dip rubber rings into boiling water and place on the jars before filling them.

When food is processed in glass jars a head space **Head space** is left at the top to permit expansion of the food.

Head space is measured from a straight edge laid across the top of the jar. Allow one-half inch of head space in all jars except those containing starchy foods (corn, peas, and lima beans); they require 1 inch because of greater expansion. The solid material in jars should be covered by liquid—water, sirup, or broth, as the case may be.

All types of glass jars can be adjusted to allow **Exhausting and cooling** the exhausting, or passing out, of air from the food during processing.

With the mason jar, the cap is screwed on until it is tight and then turned back one-fourth inch. After processing, the

cap is screwed down as tightly as possible on the jar. With the lightning type of jar, the top clamp is snapped into place and the side clamp is left up. After processing, the side clamp is pushed down. In both of these jars the actual seal is formed by the pull of the partial vacuum in the jar during cooling. Hence, it is better if these jars are cooled in an upright position.

With the vacuum- or self-sealing jars no special adjustment is used for exhausting the air. The screw bands are put on tight or the clamps adjusted. During the processing period the top is held in place by the band or clamp, which allows the air to escape but holds the top to the jar. When the jar starts to cool after processing, the steam condenses, and a partial vacuum is formed within. Greater pressure outside the jar than inside presses the top down firmly and the seal is formed between top, gasket, and jar. The sealing material hardens as the jar cools, making the seal complete. If the screw band is loose after processing, hold the lid in place so it will not turn, and screw the band tight. Jars of this type must be left to cool in an upright position. When the jars have cooled, remove the screw bands and clamps and save them to use again.

Cool all glass jars in air, out of drafts. Special care should be taken to protect jars that have just been taken from a pressure canner, as the temperature of the food is still above the boiling point. This places the glass under considerable strain, and breakage may occur if a draft strikes the jars. Leaving the jars in the canner for 3 or 4 minutes after the canner has been opened will reduce the danger of breakage. Use a jar lifter or tongs to remove the jars from the pressure canner.

Do not cover the jars with cloths or blankets while cooling as this prolongs the cooking of the food. The processing period is adequate to make the food keep, and cooling should follow at once.

After processing and cooling, all types of glass jars using rubber rings should be inverted and observed for leakage. Tap with a spoon the top of jars sealed with lacquered metal tops. A clear ringing sound denotes a seal. If the sound is dull, a seal has not been formed. First examine to see if the gasket is defective. Process the food a second time, and replace the gasket if necessary.

When glass jars are processed in the steam pressure canner there is frequently a loss of liquid.

While this may occur to some extent with all types of jars, it is generally less with those of the vacuum-sealing type, which have a separate rubber ring or sealing composition in addition to the glass or metal cap and screw band. Mason and lightning-type jars are partially sealed before they are put in the canner, and the seals are completed as soon as they are taken out. Tight sealing of these jars will not prevent the loss of liquid during pressure processing

and may cause the rubbers to push out, thus making a tight seal difficult to obtain. For adjustments of the different types of jars see page 12. Steps can be taken to reduce the loss of liquid by properly regulating the pressure canner (p. 8).

Never open the jars after processing to add more liquid.

To remove caps from the self- or vacuum-sealing jars, puncture the caps to release the vacuum and lift up. For other types of jars pull out the rubber ring with the fingers or with pliers. If this is difficult, invert the jar in warm water covering the cap and allow the jar to remain for several minutes. This will soften the rubber ring and make it easier to remove.

Bottles are convenient to use for canning liquids. **Bottles** Use the crown caps and a capping device, which may be obtained at small cost. Bottles should be boiled to sterilize them, but the caps are only dipped in boiling water just before being fixed on the bottles. Boiling the caps may prevent the formation of tight seals.

When liquids are processed in bottles it is necessary to leave about 2 inches of head space to permit expansion.

Tin Cans—If and When Available

Tin-can supplies for home canning are likely to be uncertain during the war, because of the need of conserving metals. Sealing machines, required for open-top cans, are scarce.

The following paragraphs give general information on canning in tin for the benefit of homemakers who may have access to the materials needed.

Canning in tin has some advantages; canning in glass has others. Tin cans are easy to handle because there is no danger of breakage. Also there is no loss of liquid from tin cans because they are always tightly sealed before they are processed.

Plain tin cans are made of thin sheet steel plated with tin. These cans are satisfactory for most vegetables, fruits, and meats. Some foods, however, change color when canned in plain tin because of chemical reactions due to the metals. These changes do not affect the wholesomeness of the food, but they do affect appearance. Red-colored fruits and vegetables, including most berries, cherries, currants, plums, and beets, which owe their color to anthocyanin pigments, fade when they are heated in contact with plain tin. Corn becomes darkened in color when canned in plain tin. The high temperatures necessary in processing corn cause hydrogen sulfide gas to be liberated, and this reacts with the metals of the can and forms dark-colored metallic sulfides that are deposited on the corn and on

the can. Succotash and lima beans behave in a similar manner, but to a lesser extent. With peas, some meats, and other foods the metallic sulfides may merely cause the can to mottle or darken.

Enamel-lined cans have come into use to preserve the appearance of foods that discolor in plain tin or to prevent excessive darkening or corrosion of the cans. Sanitary, fruit, or R enamel, of a deep-gold color with a bright finish, is used to keep red-colored fruits and beets from fading, and pumpkin and squash from corroding the can. C or corn enamel, of light-gold color with dull finish, is used to prevent corn, succotash, and some other products from discoloring. C enamel should not be used with acid foods or with chicken or meats that contain much fat. The acid or fat may cause this enamel to peel off and make the food unsightly, although harmless.

The following list gives the kind of enameled can recommended for different foods; other foods may be satisfactorily canned in plain tin:

C enamel	Sanitary enamel
Beans, lima (C enamel preferred; plain tin also used).	Beets (sanitary enamel preferred; C enamel also used. For pickled beets, use glass only).
Beans, red kidney (C enamel preferred; plain tin also used).	Berries, all kinds.
Corn.	Cherries.
Succotash.	Cranberry sauce.
	Pimientos.
	Plums.
	Pumpkin.
	Squash.

Gaskets Under the rim of the can lid is a gasket of paper or rubber composition, which helps to make the seal airtight. The sealing machine folds this into a double seam between the can and lid. Whether a paper or rubber composition gasket is preferable depends on the machine and the care with which it is operated (p. 17). The paper gasket is generally recommended in home canning because it is a little more bulky and more completely fills the seam made by hand-sealing machines. When the better grade of hand-sealing machines and power machines are used by experienced operators, the rubber gasket is preferred. Paper gaskets also make a better seal when reflanged cans are used. Some disadvantages of the paper gaskets are that they must be kept dry; they sometimes drop out of the cover; and they may wrinkle if wet or imperfectly adjusted, and thus cause a faulty seal.

Can sizes The usual sizes of cans for home use are No. 2, No. 2½, and No. 3. The larger sizes, No. 5 (half-gallon) and No. 10 (gallon), are generally for hotel and institution use. When No. 5 and No. 10 cans are processed under pressure special precautions must be taken to prevent the cans from

buckling. Various practical points about the use of different-sized cans are given in table 3.

TABLE 3.—Capacity and use of standard sizes of tin cans

Can size	Dimensions	Con- tents, average net weight	Vol- ume of con- tents	Products adapted to different- sized cans
No. 1, tall----	<i>Inches</i> 3 $\frac{1}{16}$ by 4 $\frac{1}{16}$ ----	<i>Ounces</i> 16	<i>Cups</i> 2	Concentrated soups, meat products.
No. 2-----	3 $\frac{1}{16}$ by 4 $\frac{1}{16}$ ----	20	2 $\frac{1}{2}$	Corn, peas, snap beans, fruits, meats.
No. 2 $\frac{1}{2}$ -----	4 $\frac{1}{16}$ by 4 $\frac{1}{16}$ ----	28	3 $\frac{1}{2}$	Fruits, vegetables, meats.
No. 3-----	4 $\frac{1}{16}$ by 4 $\frac{1}{16}$ ----	33	4	Fruits, pumpkin, tomatoes.

Packing tin cans Wash tin cans with soap and water, rinse in clear water, and drain. Lids may be wiped with a damp cloth, but gaskets, especially paper gaskets, should be kept dry to avoid difficulties in sealing.

Fill cans to obtain a reasonably tight pack of solid food without cramming and add liquid to cover—water, sirup, or broth. The desirable proportion of liquid to solids varies with different products. Uniformity of pack may be obtained by weighing the solids and adding enough liquid to cover, or by weighing both solids and liquid. Packing by weight may be desirable for large-quantity canning, as in a community center or for products intended for sale.

The liquid in the can serves two important purposes. It helps to drive out air from the can, and also to conduct heat into the solid material during processing. Foods packed without liquid require longer processing because of the slower penetration of the heat into the food.

Head space Head space is needed to prevent the cans from bulging, because of the expansion of the food during processing and storage. If a can is filled too full, it does not have sufficient head space and cannot be properly sealed; whereas too slack a fill, or excessive head space, leaves too much air in the can. Head space is measured from a straight edge across the top of the can. Since the cover goes one-eighth inch into the can, the actual head space is less after the cover is sealed on. For most foods canned at home or in community centers the following allowances are recommended, although head space varies somewhat for different products.

	<i>Head space (inch)</i>
No. 1 cans-----	$\frac{1}{4}$
No. 2 cans-----	$\frac{1}{4}$
No. 3 cans-----	$\frac{1}{2}$

When tins are used, unless most of the air in food is removed by some means before the cans are sealed, both food and can discolor, and the food loses flavor.

Exhausting It has been usual practice to pack fruits, tomatoes, asparagus, and meats raw. To save jar space, preheating fruits and tomatoes is recommended. When food is packed raw, the air is exhausted in the following ways: Place the packed cans in a bath of boiling water deep enough to come within about 2 inches of the top of the cans. Keep the water boiling without bubbling into the food and cover the bath to hold in the steam. Start counting time when the space above the cans is filled with steam, and continue to heat for the time given for the various foods. Seal the cans as rapidly as possible after the exhaust, while the food is still steaming and process at once. This method is not suitable for glass jars because of the slower penetration of heat.

The nonacid vegetables, such as beans, peas, corn, and pumpkin, are precooked to drive the air out of the tissues. They are then packed boiling hot, and the tin cans are sealed at once and processed. Fruits and tomatoes may also be precooked.

Sealing The food must be hot when the cans are sealed in order to insure a satisfactory vacuum. It is good practice to measure this sealing temperature at the center of the can with a thermometer. For tomatoes, fruits, and other foods that heat penetrates easily, the sealing temperature should be about 125° to 150° F. But for other products, such as cream-style corn, pumpkin, and squash, through which heat penetrates slowly, sealing temperatures should be 180° to 190° F. For meats, about 170° F. is recommended.

A machine is necessary for sealing open-top cans. Sealing machines must be strongly built to be durable and efficient. It is poor economy to purchase a machine too light in construction to do its work well; such a machine is likely to break and to be difficult to keep in proper adjustment for sealing the cans tightly. For home canning a hand-operated machine is satisfactory, but for continual use, as in a community canning center, power operation may be desired.

Different makes of sealing machines vary in design, and the manufacturer's instructions regarding the care and operation of the machine should be followed. With all types, however, the actual seaming process of the cans is the same. The filled can with cover is set on the base plate and is raised by a lever until the chuck of the machine fits closely into a countersink about one-eighth inch deep in the top of the can lid. The can is rotated while the first seaming roll of the machine folds the flange of the cover over the flange of the can. The second seaming roll of the machine then presses the folded layers

together into a tight seam which is made airtight by the gasket of the lid. The seaming rolls should be observed frequently to see that they are in proper adjustment. Some machines are furnished with a wire or other means of testing the adjustment of the seaming rolls.

The finished seam between lid and can should be smooth and even. A way to try out the adjustment of the sealer is to test the tightness of the seam on a can. Place a few tablespoons of water in a can, seal it, then submerge it in boiling water for a few minutes. If air bubbles come up from the can, the seam is not tight.

After processing tin cans of up to and including the No. 2½ size, open the pet cock on the pressure canner to let the steam escape gradually, as the pressure drops to zero. With No. 3 cans and larger sizes, allow the pressure gage to come to zero; then open the pet cock gradually.

Cool tin cans at once in cold water, preferably running water, until they are lukewarm, or about 100° to 105° F. If the cans have paper gaskets, use only water suitable for drinking. When the cans are cool, wipe off any remaining moisture and examine for leaky seals.

Tin cans are sometimes reflanged for use a second time by means of special attachments on the sealing machine both for opening the cans and for reflanging. Cans that are corroded or very much discolored should never be used a second time. Also, unless the reflanging is properly done and the sealing machine is adjusted to handle reflanged cans, it is impossible to obtain a tight closure. The use of reflanged cans, therefore, is not generally recommended.

Other Utensils and Supplies

Most of the utensils needed for home canning are in common use in the kitchen. In addition to the containers and processing equipment and a worktable and sink, the following utensils are generally needed:

Shallow pans.	Jar tongs.
Preserving kettles.	Long-handled spoons.
Colander.	Stainless-steel paring knives.
Wire basket or cheesecloth.	Cutting knife.
Jar funnel.	Scissors.
Quart measure.	Household scales.
Standard measuring cup.	Vegetable brush.
Ladle or dipper.	Thermometer.

Special devices may be provided if desired for paring apples and peaches; coring apples, pears, and tomatoes; pitting peaches and cherries; shelling peas; and slicing, cubing, grinding, and sieving food materials.

The thermometer should be of the type that can be immersed in

liquids, and should register at least to 220° F. A candy or dairy thermometer may be used, and can usually be obtained through local dealers for about a dollar.

When fruits are being canned for sale a sugar tester or saccharometer is very useful to measure the concentration of sugar in the sirups. The Brix and Balling saccharometers or hydrometers indicate directly the percentage of sugar in the solution. The Baumé saccharometer differs in the scale and does not indicate the percentage of sugar directly. The approximate percentage is obtained by multiplying the reading by 2. A saccharometer costs about 75 cents.

Utensils for cooking foods for canning may be of aluminum or a good grade of enamelware or stainless steel. Do not use galvanized-iron utensils for cooking any food or for holding acid foods with cut surfaces, as the foods will take up zinc and become poisonous. Copper or copper-lined utensils may be used for cooking fruits and vegetables, provided the utensils are kept bright and shiny so that no copper salts accumulate and provided the food is removed from the utensils at once after cooking.

The water used for various purposes in canning, such as washing food and utensils, cooking, making sirups, and cooling cans, should be suitable for drinking. Very hard water may toughen vegetable tissues or make fruit sirups cloudy. Such water can be partially softened by boiling and straining through several thicknesses of muslin. Or the boiled water may be allowed to stand until the fine precipitate settles and the clear water then poured off for use.

STEPS IN CANNING

Safe canning requires careful attention to every step in the process—from the selection of the raw food to the final check-up of the canned products during storage. The following list gives the steps in order.

- Select good materials.—The quality of canned products can be no higher than the quality of the raw food that goes into the can. Use only clean, fresh, sound foods in prime condition, and be sure that the containers in which they are handled are clean. Any unnecessary infection of the raw food increases the difficulty of processing and the liability of the canned products to spoilage.

With fruits and vegetables, grade for size and the same degree of ripeness if a uniform product is desired. Wash thoroughly until every trace of soil is removed. The most dangerous bacteria and those most difficult to kill are in the soil. A wire basket is a help in washing but should not be loaded too heavily. Always lift the fruit and vegetables out of the water rather than pour the water off.

For special precautions about meats, see page 37.

- Prepare jars or cans.—Follow the directions for glass jars on page 12 and those for tin cans on page 16.
- Sirup.—Make the sirup for fruits in advance so there will be no delay when it is required (p. 22).
- Precooking.—Some foods are precooked for a short time before they are packed into the containers. This precooking helps to remove air from the tissues, shrinks them, facilitates packing, and speeds up the processing because the foods are already hot when they are placed in the canner.
- Packing.—When using glass jars, remove one jar at a time from the hot-water bath where it has been held. Keeping the jars hot helps to prevent breakage during packing and processing. If needed, place a new wet rubber ring in position, resting flat on the sealing shoulder of the jar.

Pack the containers quickly so that the precooked food remains hot. Use a sufficient proportion of liquid to solids to prevent too dense a pack, and work out the air bubbles with a knife blade or spatula.

Leave the proper head space in the containers (pp. 12 and 16).

- Exhausting and adjusting covers.—Food in glass jars is exhausted, or the air partially removed during processing, because the jars are not fully sealed. As each glass jar is packed, carefully wipe the rubber ring and sealing edge of the jar to remove any particles of food, and adjust the cap to seal the jar partially and permit exhausting (p. 12). Place the jars as finished in the canner or where they will keep hot until processing begins.

Tin cans packed with precooked food should be sealed at once, while the food is steaming hot, and placed in the canner. If the food has not been precooked before packing, it should be exhausted (p. 17). Seal the cans at once after exhausting.

- Processing.—Process at the temperature and for the time indicated in the tables on pages 30–31, 34–35, 45.

● Cooling.—Cool glass jars in air but protect them from drafts. After they are cool, invert rubber-ring jars and observe for leakage. Test lacquered metal-top jars by tapping (p. 13). Do not attempt to tighten screw caps or screw bands after jars have cooled. Cool tin cans in cold water, using running water if possible.

- Reprocessing.—If a container leaks, determine the cause. Process the food again, using another container, top, or ring, as needed.

● Labeling.—Wipe the containers clean and label with the name, the date, and the lot number, if more than one lot was canned on that day. Glass jars may be labeled with a pencil that writes on glass or with gummed labels. Use rubber cement to fix paper labels on tin,

or if the labels are long enough, put glue along one end, wrap smoothly around the can, and lap the glued end over the other. Or tin cans may be marked with a glass pencil, rubber stamp, or canners' ink.

● **Checking up results.**—Hold canned products at room temperature for a week or 10 days where they can be examined from time to time to be sure that they are keeping. If any show signs of spoilage, examine all of that lot carefully.

● **Storage.**—Store canned foods in a cool, dry place, and protect glass jars from the light so that the food will not fade in color. The quality is generally better if they are used within the first year after canning.

CANNING FRUITS, TOMATOES, AND OTHER ACID FOODS

Fruits, tomatoes, and other acid foods are best processed at 212° F., the temperature of boiling water at sea level. Read carefully the sections under Canning Equipment and Methods that relate to the handling of acid foods. The boiling-water bath is the most successful way of applying heat for processing foods of this type in the home.

The higher temperatures reached in a pressure canner are not only unnecessary for these foods, but acid foods become overcooked when processed under steam pressure.

Figures in table 4 are a rough guide to quantities of raw fruit required in canning.

TABLE 4.—Amount of raw fruit needed for 1 quart or 1 No. 3 can of canned fruit

Fruit	Quantity raw	
	Pounds	Units
Apples.....	2½	7 to 8 apples.
Berries.....	1¼ to 1½	5 cups
Cherries.....	1¼ to 1½	6 cups.
Peaches.....	2 to 2½	8 to 10 peaches.
Pears.....	2 to 2½	5 to 6 pears.
Plums.....	1½ to 2	24 to 32 plums.
Tomatoes.....	2½ to 3½	8 to 10 tomatoes.

The following figures based on extensive canning work in Texas give the approximate number of pounds of raw fruit to a bushel: Apples, 50; blackberries, 60 (a 24-quart crate of blackberries is 36 pounds); peaches (standard), 50; pears, 58; plums, 56; tomatoes, 56.

Fruits With or Without Sugar

Cane and beet sugar are equally good in sweetening fruit for home canning. Brown sugar is not recommended for this purpose, as it may contain spoilage bacteria or other impurities.

Fruits naturally contain a great deal of water, and the most economical way to use sugar when it is limited is to add a small amount directly to the fruit. This is preferable to covering the fruit with a thin sugar-and-water sirup, which means canning extra water. This canning in juice makes the most of natural fruit flavor. Canned fruits thus prepared may not look so attractive as products which homemakers are accustomed to pack but have more fruit flavor and food value.

Why pack hot?—Packing fruits hot into containers offers several advantages. The precooking draws out juice for covering fruit when packed in jars. Precooking shrinks the fruits, so that more generous amounts may be packed in containers. Precooking cuts down the time that packed fruits need to be processed in the water bath.

To draw juice out of the more juicy fruits, such as
Fruits in their own juice berries, cherries, plums, ripe peaches and pears, sweeten the fruits to taste and bring to the boiling point slowly. To avoid scorching, stir from time to time, or set the pan in hot water, or cover the pan and place in a moderate oven. If juicy fruits are cut or sliced, they will probably form enough juice in this process for canning liquid.

If juicy fruits are to be canned whole or in halves, some added liquid may be needed. Fruit juice may be used for this instead of the usual sirup. To provide juice, set aside the riper fruits at the start. Crush and heat these to boiling point and extract juice. Sweeten juice as necessary. Heat the firmer fruits in this juice, and pack the fruit quickly into jars or cans, cover with the boiling hot juice, and process.

For shortcakes, frozen desserts, and pies, crush or make a sauce of some fruit. Sweeten as desired and heat before packing into jars.

Apples and some kinds of peaches and pears may not yield enough juice for canning liquid. To get the most possible juice, slice or cut these fruits and add sugar before heating, as for juicy fruits. Add a little water, if necessary, to prevent sticking. Fill into jars and cover with the hot juice and process.

If fruits are to be canned in a sirup made with
In sirup water, prepare the sirup in advance, to be ready when needed. Standard proportions are shown in table 5. The present sugar canning ration of 1 pound of sugar for every 4 quarts of finished fruit can be used to make thin or moderately thin sirup, allowing from $\frac{3}{4}$ to 1 cup of sirup to each jar.

TABLE 5.—Proportions of sugar and water for thin, medium, and moderately heavy sirups

Sirup	Sugar to 1 gallon of water				Degrees Balling or percent of sugar
	Cups	Quarts	Pounds	Ounces	
Thin.....	5	1¼	2	2	20
Moderately thin.....	8	2	3	10	30
Medium.....	12½	3⅓	5	9	40
Moderately heavy.....	19	4¾	8	6	50

Boil the sugar and water for approximately 5 minutes to make a sirup. Remove any scum that has formed. A heavy sirup may be prepared and diluted with water to yield thinner sirups as required.

Honey may be used to replace up to one-half the sugar called for in canning, and corn sirup up to one-third.

Without sugar Fruits for pie making or for use in diabetic diets are commonly canned without sugar. Juicy fruits, such as berries, cherries, currants, and plums, should be canned in their own juices when sugar is omitted. Water is not required. Extract the juice from the riper fruits by crushing, heating, and straining. Pack the remaining fruits closely into containers without preheating, and add boiling hot juice to cover. Adjust caps on glass jars; or exhaust tin cans and seal; then process. Or give the fruits a short precooking, as 2 to 4 minutes simmering, pour into containers at once, seal, and process.

The less juicy fruits, such as apples, peaches, and pears, when canned without sugar require the addition of water. To preserve the natural fruit flavor use only the smallest quantity of water necessary. Follow the directions for canning given on pages 23 to 29, substituting water in place of the sirup.

Packing and Processing

Apples

Pare the apples and cut into pieces of desired size. To prevent darkening of pieces exposed to air, place them in a mild salt and vinegar solution (2 tablespoons salt and 2 tablespoons vinegar to a gallon of water). Precook by boiling 5 minutes, adding a little sugar to draw out juice. Fill hot into jars or cans, covering with boiling hot juice, or with sirup if there is not enough juice. If apples are being canned for use in pies, pack the containers solidly, using as little

juice as possible. Allow head space (for jars see page 12, for cans see page 16).

Windfall or green apples may be made into sauce. Pack boiling hot.

Process apples as directed in table 6.

Apricots

Same as peaches.

Beets, pickled

Select beets of uniform size, cut off the tops, but allow at least 1 inch of the stems to remain so that the beets will not bleed and lose color and sweetness. Wash and cook until tender in enough water to cover. For young beets this will require about $\frac{1}{2}$ hour. When tender, plunge into cold water and remove the skins, and when cool, dice or cut into thin slices. Pack into jars and to each pint add $\frac{1}{2}$ teaspoon of salt. Fill with a boiling hot vinegar and sugar sirup of desired sweetness. Make sirup by proportions in table 5, substituting vinegar for water. Very strong vinegar may be diluted by using one-fourth water. Process immediately as directed in table 6.

Berries

Blackberries, blueberries, dewberries, huckleberries, Logan blackberries, raspberries—gather them in shallow vessels so as to prevent crushing, and plan to can them as soon as possible. Wash carefully and remove caps and stems. Sort out smaller and less perfect berries to make a juice and sugar sirup of desired sweetness, use juice instead of water (for proportions see table 5), and heat together to dissolve the sugar. For the most economical pack, precook berries in this juice. Fill carefully into the container and cover with the hot juice.

For use in pies where the appearance of the whole fruit is not important, precook the berries with sugar added to sweeten lightly. Stir gently and let the fruit boil 3 to 4 minutes. Pack boiling hot. Raspberries and other berries of soft texture keep their shape better for dessert purposes if packed raw, although they tend to rise to the top of the container after processing. Cover them with the hot juice and sugar sirup made from the softer berries; or cover with a hot sugar and water sirup made by proportions in table 5.

If tin cans are used, exhaust them for 3 to 5 minutes before sealing.

Process berries as directed in table 6.

Cherries

Cherries may be canned pitted or unpitted, depending upon the way in which they are to be served.

If the fruit is pitted, save all juice. Cook the cherries 5 minutes over low heat in this juice to shrink them. Add sugar to taste. Pack hot, covering the cherries with boiling hot juice.

If cherries are unpitted, pack the raw fruit in hot containers and cover with hot juice obtained by heating other cherries with sugar; or cover with hot sirup made by proportions in table 5.

If tin cans are used, exhaust for 3 to 5 minutes before sealing.

Process cherries as directed in table 6.

Currants

Same as berries.

Gooseberries

Precook in sirup to shrink. Fill into containers and cover with hot sirup. If tin cans are used, exhaust for 3 to 5 minutes before sealing. Or, add a small quantity of water to the gooseberries after they have been sorted and washed and boil until they are cooked to a pulp. To each quart of this pulp add sugar to sweeten lightly or up to $\frac{1}{2}$ cup per quart if needed. Heat until the sugar is dissolved and pack boiling hot into containers. If packed raw, use the method suggested for berries.

Process as directed in table 6.

Peaches

To prepare peaches for canning, immerse them in boiling water for about one-half minute or until the skins will slip easily, plunge at once into cold water for a few seconds, remove the skins, cut the peaches into halves, and discard the pits.

If a bushel or more of peaches or apricots is to be canned at one time, the skins may be removed in a lye bath. This method is not justified with a small quantity, unless the peaches are so firm that hot water will not loosen the skins. Be careful in using lye, especially if children are around, for it is a powerful caustic, and serious accidents have happened.

To peel peaches or apricots with lye, prepare in an agateware or iron kettle (never aluminum) a solution of one-fourth pound (4 ounces, or about 4 level tablespoons) of granulated lye of a standard brand in 2 gallons of water. Heat to boiling, and while the solution is actively boiling, immerse the peaches or apricots in it in a wire basket until the skin is loosened and partially dissolved. This will usually require 30 to 60 seconds. Remove the fruit, wash it at once in running water, if possible, until skin and lye are removed, and then thoroughly rinse the fruit. If the lye is not thoroughly rinsed off, the peaches may turn brown as a result. A 2-minute dip in a bath with 2 tablespoons each of salt and vinegar to each gallon of water also helps to prevent the fruit from browning. Lye-peeled fruit should be canned immediately.

If a thermometer is available it is better to use a stronger lye solution at a lower temperature. An 8- to 10-percent solution con-

taining 1 pound of lye to 1½ gallons of water heated to 135° to 140° F. (not higher) is recommended.

Peaches may be packed raw but a better pack is obtained if they are precooked for a few minutes. Precooking brings out juice which is usually sufficient to cover the fruit. Juice is extracted more readily from sliced peaches than from halves. If peaches are juicy, heat slowly to boiling point and add sugar to help draw out juice. Be careful not to cook peaches until they are soft. If peaches are of less juicy varieties, a sirup may be prepared according to proportions in table 5, and the peaches precooked like juicy peaches, but in the sirup.

Pack precooked peaches quickly. Sliced fruit takes up less jar space. If the fruit is cut in halves, place them pit side down in overlapping layers. Cover the peaches with boiling hot juice or sirup in which they were precooked. If necessary, add a little boiling hot water, since fruit must be covered by liquid.

If peaches are packed raw in tin cans, cover with hot sirup and exhaust the cans for 5 minutes before sealing.

Process peaches as directed in table 6.

Pears

Peel pears, cut them in halves, and core. Slice if desired. To prevent discoloration place the pared fruit in a solution made in the proportion of 2 tablespoons each of salt and vinegar to a gallon of water. Cook in boiling water or sirup (for sirup proportions see table 5) for 4 to 8 minutes, according to the size and firmness of the fruit. When pears are very juicy heat slowly, without adding sirup, to draw out juice for covering. Pack pears hot into containers and fill with boiling hot liquid. If packed raw in tin cans, cover pears with hot sirup and exhaust for 5 minutes before sealing.

Process pears immediately as directed in table 6.

If Kieffer pears are to be canned, quality is improved by holding the fruit for 2 weeks after harvest at a temperature of 60° to 65° F. before canning.

Pimientos, ripe

Select ripe, thick-fleshed pimientos, free from bruises. To remove the skin, immerse the whole peppers in hot cooking oil (290° F.) for 2 or 3 minutes, or place them in a hot oven (450°) for 6 to 8 minutes; then dip quickly into cold water. Slip the skins off, remove stems and seed cores. The peppers are then soft and pliable. Fold and pack them into the containers, and add one-half teaspoonful of salt to each pint. Add no liquid because the processing brings out almost enough thick liquor to cover them. If tin cans are used, exhaust them for 5 minutes before sealing. Process immediately as directed in table 6.

Pineapples

Peel, core, and remove "eyes." Slice or cut in pieces; add sugar to taste. Heat slowly for 10 to 15 minutes to draw out juice. Pack into containers and cover with the hot juice. Process immediately as directed in table 6.

Plums

Plums are ordinarily canned whole and should be gathered just as they are beginning to ripen. Wash; prick each plum to prevent the skin from bursting. Precook in small amount of sirup (see proportions in table 5). Pack plums into containers and cover with boiling hot sirup. Exhaust tin cans for 5 minutes before sealing.

If preferred, prepare sauce by straining out pits and skins and cooking pulp with enough sugar to sweeten lightly. Fill into containers boiling hot.

Process plums as directed in table 6.

Rhubarb

Select young, tender stalks; trim, wash, and cut into half-inch lengths. Boil until soft with enough sugar to sweeten. Since rhubarb corrodes tin cans, it is better for home use to pack it in glass. Pack boiling hot into jars and process immediately as directed in table 6.

Sauerkraut

Sauerkraut should be well fermented before it is canned. Heat the sauerkraut to simmering (about 180° F.), but avoid boiling. Fill hot into the containers and pack closely. Cover with the hot sauerkraut juice, leaving $\frac{1}{8}$ - to $\frac{1}{4}$ -inch head space. Process immediately as directed in table 6.

Strawberries

Strawberries are usually more palatable preserved than canned. In canning, this method gives best results: To washed and stemmed berries add sugar to taste. Bring slowly to the boiling point and let stand overnight in the kettle. In the morning bring quickly to boiling and fill into the containers.

Or, place capped berries in shallow pans in a single layer. Sweeten the berries to taste. Place in an oven that can be held at 250° F. and leave for an hour. Pack hot in sterilized jars, covering with the hot juice.

Process strawberries as directed in table 6.

Tomatoes

Select firm, ripe tomatoes of medium size and uniform shape, free from spots and decay. Put into trays or shallow layers in wire baskets and dip in boiling water for about a minute, according to ripeness. Then plunge quickly into cold water, drain, peel, and core promptly.

Pack into the containers as closely as possible. Fill with tomato juice and add 1 teaspoon of salt per quart. If using tin cans, exhaust them 5 to 6 minutes before sealing.

Or cut the tomatoes in quarters, heat just to boiling, and pack hot. Process as directed in table 6.

Tomato juice

To preserve the natural flavor and color in canned tomato juice, use knives of stainless steel and avoid utensils of copper, brass, and iron. Use only fully ripe, firm tomatoes, preferably of bright-red color, as freshly picked from the vines as possible. Discard any with green, moldy, or decayed portions. Wash well, remove cores, and cut into small pieces. The skins may or may not be removed. Handle the tomatoes in quantities of 1 to 2 gallons and avoid delay at any stage of the procedure. Precook the tomatoes at about 170° F. to 180° F., or if a thermometer is not available, simmer until softened. Avoid boiling. Put the softened, hot tomatoes at once through a fine sieve, preferably a bowl- or cone-shaped sieve because it allows the least air to be incorporated in the pulp. If the tomato juice is for infant or invalid use, omit salt; otherwise add one-half to 1 teaspoon salt to each quart. Spices tend to darken the color of tomato juice and change the flavor undesirably; hence it is better to add them at the time of serving.

Reheat the juice at once after putting through the sieve. If using glass containers, heat the juice to 190° F. (or just to boiling), pour into the sterilized containers, and seal. No processing is necessary. Invert the bottles while cooling. If tin cans are used, heat the juice to 180° to 190° (or to simmering if no thermometer is available), pour into cans, seal, and process the cans as directed in table 6. Do not leave head space in either glass or tin containers.

Fruit juices

Fruit juices for beverages may be extracted from berries, cherries, currants, grapes, and plums. Use only sound, well-ripened fruit in such quantities that the process can be carried through promptly. To avoid overcooking and to preserve as much as possible of the original flavor and color, check the temperature with a thermometer as the fruit is pre-cooked and the juice is pasteurized. Sugar also helps to preserve color and flavor, but it may be omitted.

Wash the fruit, drain, and crush. Remove the seeds from cherries before crushing as seeds change the flavor of juice. Add water, if desired, to thin the juice, about one-half cup to each pound of fruit, except to berries which require no water. Heat to 170° to 180° F., and hold for several minutes, or until the juice can be separated from the pulp. Extract the juice with a fruit press or strain through several layers of cheesecloth. If a press is used avoid crushing the

seeds of berries. Crushed seeds spoil the flavor. A second straining without pressure makes the juice clearer. Add sugar if desired, about $\frac{1}{2}$ to 1 cup of sugar to a gallon of juice. Heat the juice to 160° to 170° F. and fill into hot, sterilized glass jars or bottles to within one-eighth inch of the top. Seal at once, and lay bottles on their sides in the water bath. Process immediately as directed in table 6.

Fruit purees

For purees of almost any soft fruit put the cooked fruit through a fine sieve; otherwise proceed as for fruit juice. Process as directed in table 6.

TABLE 6.—Timetable for processing fruits, tomatoes, and other acid foods

The times given here for processing in the boiling-water bath apply only to places with altitudes of 1,000 feet or less. For all altitudes above 1,000 feet, the time should be increased 20 percent for each additional 1,000 feet.

When half-gallon glass jars are used, add 5 minutes to times given for pint and quart glass jars.

Process the containers immediately after packing.

Cool the food in tin cans in cold water immediately after processing.

Product	Style of pack	Processing period in boiling water 212° F.		Type of tin can
		Pint and quart glass jars	No. 2 and No. 3 tin cans	
		<i>Minutes</i>	<i>Minutes</i>	
Apples.....	{ Boil, pack in hot juice or sirup.....	15.....	10.....	Plain tin.
	{ Same as above but dry-pack.....	20.....	15.....	Do.
	{ Applesauce, pack hot.....	5.....	5.....	Do.
Apricots.....	{ Precook and pack hot.....	15.....	15.....	Do.
	{ Pack raw; cover with hot sirup.....	25.....	{ No. 2, 15..... No. 3, 25..... }	Do.
Beets, pickled.....	Pack hot.....	30.....	
Berries:				
Blackberries.....	{ Precook and pack hot.....	5.....	5.....	Sanitary enamel.
Blueberries.....		20.....	15.....	Do.
Dewberries.....		5.....	5.....	
Huckleberries.....		20.....	15.....	
Logan blackberries.....		5.....	5.....	Do.
Raspberries.....		25.....	20.....	Do.
Cherries.....	{ Precook and pack hot.....	5.....	5.....	Do.
	{ Pack raw; cover with hot juice or sirup.....	25.....	20.....	Do.

Currants	Precook and pack hot	5	5	Do.
Gooseberries	Precook and pack hot	5	5	Do.
	Pack raw; cover with hot juice or sirup	20	15	
Peaches	Precook and pack hot	15	15	Plain tin.
	Pack raw; cover with hot sirup	Soft, 25	Soft, 20	Do.
		Firm, 35	Firm, 30	
Pears	Precook and pack hot	20	20	Do.
	Pack raw; cover with hot juice, water, or sirup		No. 2, 20	Do.
			No. 3, 25	
Pimientos, ripe	Pack hot	Pint, 40	No. 0, 30 No. 1, 30	Sanitary enamel.
Pineapples	Pack hot	25	No. 3, 30	Plain tin.
Plums	Precook and pack hot	5	5	Sanitary enamel.
	Pack raw; cover with hot sirup	20	15	Do.
Rhubarb	Precook and pack hot	5	5	Do.
Sauerkraut	Precook and pack hot	Pint, 25	No. 2, 15	Plain tin.
		Quart, 30	No. 3, 30	
Strawberries	Precook and pack hot	5	5	Sanitary enamel.
Tomatoes	Precook and pack hot	5	5	Plain tin (preferred); or sanitary enamel.
	Pack raw	45	35	
Tomato juice	Pack hot	No processing	5	Do.
Fruit juices:				
Berries	Pack at 160° to 170° F. and process in water bath at 180°.	20		
Cherries				
Currants				
Plums				
Fruit purees	Pack at 160° to 170° F. and process at 212°	20		

CANNING NONACID VEGETABLES

Nonacid vegetables require processing in the steam pressure canner at temperatures of 240° and 250° F. If a pressure canner is not available, then drying, brining, or some method of preservation other than canning should be used for these vegetables.

In estimating the approximate yield of canned products from raw vegetables the figures in table 7 are a guide.

TABLE 7.—Approximate yield of canned products from raw vegetables

Vegetable	Quantity raw	Yield as canned product
Asparagus, whole-----	2 pounds-----	1¼ pints or No. 2 can.
Beans, shelled, lima-----	do-----	1 quart or No. 3 can.
Beans, snap-----	1½ pounds-----	Do.
Beets, baby, without tops-----	2½ to 3 pounds-----	Do.
Corn-----	4 to 6 ears-----	1¼ pints or No. 2 can.
Greens-----	1 pound-----	Do.
Peas, green:		
In pods-----	2½ to 3 pounds-----	Do.
Shelled-----	1 pound-----	Do.
Pumpkin-----	4 pounds-----	1 quart or No. 3 can.
Sweetpotatoes-----	2½ to 3 pounds-----	Do.

Packing and Processing

Asparagus

Select fresh and tender stalks, sort according to size, and wash thoroughly. Tie in uniform bundles, stand upright with tough portion in boiling water, cover tightly, and boil for 2 to 3 minutes. Or cut in half-inch lengths, add enough water to cover, and boil for 2 minutes in an uncovered vessel. Pack boiling hot into containers, cover with the water in which boiled, and add 1 teaspoon of salt to each quart. Or pack raw in No. 2 tin cans, cover with boiling water, and exhaust for 4 to 5 minutes before sealing. Process immediately as directed in table 8.

Beans, fresh lima

Only young and tender lima beans should be canned; older ones may be dried. Shell, wash, and bring to a boil in water to cover. Pack hot into the containers, cover with hot water, and add 1 teaspoon of salt to each quart. Process immediately as directed in table 8.

Beans, snap

Wash thoroughly and cut into pieces of desired size. Add boiling water to cover and simmer uncovered for about 5 minutes, or until the beans are wilted and will bend without breaking. Pack hot into the containers, cover with hot water, and add 1 teaspoon of salt to each quart. Process immediately as directed in table 8.

Beans, dried kidney or pinto

Pick over the beans, wash, and soak overnight in a cool place. Drain. Blanch in boiling water for 3 to 4 minutes and drain. Fill at once into containers to about seven-eighths capacity. Cover with boiling water containing 2 ounces each of salt and sugar to the gallon. The sugar may be omitted or replaced by molasses if desired. Small pieces of salt pork may be added. Process immediately as directed in table 8.

Soybeans

Either green or dried soybeans of varieties suitable for table use may be canned. The green soybeans make a better product, however, in both flavor and color. Follow the directions given above for kidney beans, except with green beans omit the overnight soaking and do not add sugar. Salt pork may be added if desired.

Beets, baby

Select young, tender beets preferably of the turnip-shaped varieties. Trim off the tops, but leave on at least 1 inch of the stems and all of the roots to prevent bleeding. Wash thoroughly and scald in boiling water or steam for about 15 minutes until the skins slip easily. After the beets are skinned and trimmed, pack into the containers, add 1 teaspoon of salt to each quart, and fill with hot water. Process immediately as directed in table 8. Pickled beets may be processed in the boiling-water bath (p. 24).

Carrots

Young tender carrots may be canned in the same way as baby beets.

Corn

Use only tender, freshly gathered sweet corn, shuck, silk, and clean carefully.

Sweet corn is canned in two styles—whole grain and cream style. Whole-grain corn is cut from the cob without scraping, while for cream style the corn is given a more shallow cut and the cobs are scraped. Corn for the whole-grain pack should be gathered 3 or 4 days earlier than for cream-style corn. The whole-grain product retains the appearance and flavor of fresh corn more nearly than the cream style because it can be given a lighter processing and therefore is not so likely to be overcooked. When cream-style corn, which is thick and viscous, is canned in glass jars, it sometimes becomes brownish in color because of the caramelization of the sugar by the heavy processing required. Whole-grain corn has less tendency to discolor when packed in plain tin cans than does cream-style corn, though the C enamel cans give better results for both.

For the whole-grain style, cut the corn from the cob deeply enough

TABLE 8.—Timetable for processing nonacid vegetables in the steam pressure canner

The processes given here apply to places with altitudes of 2,000 feet or less. At altitudes over 2,000 feet, add 1 pound pressure for each additional 2,000 feet. Follow the directions on pages 8, 13, and 18 for operation of canner and removal of jars and cans after processing. Cool tin cans in cold water immediately after processing.

Product	Pint glass jars		Quart glass jars		No. 2 tin cans		No. 3 tin cans		Type of tin can
	240° F., or 10 pounds pressure	250° F., or 15 pounds pressure	240° F., or 10 pounds pressure	250° F., or 15 pounds pressure	240° F., or 10 pounds pressure	250° F., or 15 pounds pressure	240° F., or 10 pounds pressure	250° F., or 15 pounds pressure	
	<i>Minutes</i>	<i>Minutes</i>	<i>Minutes</i>	<i>Minutes</i>	<i>Minutes</i>	<i>Minutes</i>	<i>Minutes</i>	<i>Minutes</i>	
Asparagus.....	30		35		30				Plain tin.
Beans:									
Fresh lima.....	50		55		40		50		C enamel or plain tin.
Snap.....	30		35		25		30		Plain tin.
Dried kidney or pinto.....	80		90		70		85		C enamel or plain tin.
Soybeans.....	80		90		70		85		Do.
Beets, baby.....	30		35		30		30		Sanitary enamel.
Carrots.....	30		35		30		30		Plain tin.
Corn:									
Whole-grain.....	60		70		50		65		C enamel.
Cream-style.....		75				70			Do.
Greens.....		60		65		55		No. 2½, 60	Plain tin.
Mushrooms.....	25		35		25		25		Do.
Okra.....	35		40		25		30		Do.

Okra and tomatoes	25		35		25		30	Plain tin.
Peas:								
Green	45				40			Do.
Black-eyed	50		55		40		50	Plain tin or C enamel.
Pumpkin		60		75		60		Sanitary enamel.
Squash		60		75		60		Do.
Sweetpotatoes	95		120		95		115	Do.
Vegetable-soup mixtures	60		70		50		65	Plain tin.

to remove most of the kernels without objectionable hulls. Do not scrape the cobs. Add 1 teaspoon of salt to each quart of corn and half as much boiling water as corn by weight. Heat to boiling and pack into containers at once. Process immediately as directed in table 8.

For the cream style, with a sharp knife lightly cut off the tops of the kernels, and with the back of the knife scrape out the pulp. This gives a thick, pasty mass with the minimum of hulls. Add 1 teaspoon of salt to each quart, and half as much boiling water as corn by weight. Heat to boiling, and fill into containers at once. Process immediately as directed in table 8.

Greens

Pick over the greens, discarding any imperfect leaves and tough fibrous stems. Wash carefully in running water or through a number of waters, lifting the greens out each time. To precook, cover the greens with water heated to simmering, not boiling, and cook in an uncovered vessel for 5 minutes, or until the greens are wilted. Pack hot into the containers, taking care not to make too solid a pack and to have sufficient hot liquid to cover the greens. Add 1 teaspoon of salt to each quart. Process immediately as directed in table 8. Greens should not be canned in No. 3 tin cans, because of the difficulty of heat penetration.

Mushrooms

Wash thoroughly, peel mature mushrooms, and drop into water containing 1 tablespoon of vinegar per quart. Precook, place in a wire sieve or colander, cover with a lid to hold the mushrooms under water, and immerse for 3 to 4 minutes in boiling water that contains 1 tablespoon of vinegar and 1 teaspoon of salt per quart. Fill into containers at once and cover with freshly boiling water. Add 1 teaspoon of salt to each quart. Process immediately as directed in table 8.

Okra

Only young, tender pods should be canned; older pods should be dried. After the okra is washed, cover with water, bring to a boil, and pack hot into the containers. Add 1 teaspoon of salt to each quart. Process immediately as directed in table 8.

Okra and tomatoes

Use only young, tender okra and sound, ripe tomatoes. Wash the okra and slice crosswise. Wash the tomatoes, remove the skins and cores, and cut into sections. Combine the okra and tomatoes and heat to the boiling point. Pack while hot, and add 1 teaspoon salt to each quart. Process immediately as directed in table 8.

Peas, green

Use only young, tender peas. Shell, wash, add hot water to cover, and simmer for about 5 minutes. Pack hot in pint jars or No. 2 tin

cans, cover with hot water, and add one-half teaspoon of salt to each pint. If tender peas are packed in quart jars or No. 3 cans they become overcooked and mushy. Process immediately as directed in table 8.

Peas, black-eyed

Same as lima beans.

Pumpkin

Wash, peel, and cut the pumpkin into 1- to 1½-inch cubes. Add a small quantity of water and simmer until heated through, stirring occasionally. Pack hot into containers, add 1 teaspoon of salt to each quart, and cover with the water in which cooked. Process immediately as directed in table 8.

Squash

Same as pumpkin.

Sweetpotatoes

Where sweetpotatoes can be stored successfully, only enough should be canned to take care of the season during which the stored potatoes are not available. Or if in harvesting more are cut with the plow than can be used immediately, they may be canned in order to save them. In that case, precook them slowly in order to develop the sugar.

Wash the sweetpotatoes thoroughly and boil or steam them until the skins slip off readily. Peel quickly, cut into medium-sized sections, and pack hot into containers. Add 1 teaspoon of salt to each quart and enough boiling water to cover. Process at once as directed in table 8.

Vegetable-soup mixtures

The combinations of vegetables for soups may include two or more of the following: Tomato pulp, corn, lima beans, peas, okra, carrots, turnips, celery, onion, pimientos, and sweet and red peppers. Wash and trim the vegetables and cut into small pieces or cubes. Keep the diced carrots and turnips covered with water or weak brine to prevent darkening. Seasonings should be light, and may include sugar, salt, white pepper, dashes of cayenne and garlic, parsley, thyme, and bay leaf.

Bring the soup mixture to the boiling point, and pack hot, with sufficient liquid to cover the vegetables and prevent too dense a pack. Process as directed in table 8.

CANNING MEATS AND CHICKEN

Beef, veal, mutton, lamb, pork, and chicken may be canned successfully in the home, provided they are processed under steam pressure. The temperatures required for effective sterilization (240° to 250° F., corresponding to 10 and 15 pounds steam pressure) can-

not be obtained inside the can or jar except by the use of the steam pressure canner. The water bath, the oven, and the steamer without pressure are inadequate for canning meats and cannot be used safely. Insufficiently processed meat may keep if stored at a low temperature, but even when no visible signs of spoilage are observed there is no certainty that the bacteria which cause food poisoning have not been active. If a pressure canner is not available, other methods of preservation should be used for meats.

While a variety of meat and poultry products may be canned, it is more economical of can or jar space to put up the meat alone and combine it with the other foods at the time of serving. This also permits greater variety in the use of the meat, and combinations with fresh, crisp vegetables as well as a wider choice of seasonings. Onion, garlic, and spices should be used sparingly, and white pepper retains a better flavor than black pepper in meat products.

All meats and poultry for canning should be slaughtered and handled in a strictly sanitary manner. Unless the meat is to be canned at once, chilling the carcass after slaughtering is necessary; otherwise decomposition will start within a few hours. There is little difference in the flavor or tenderness of the canned product whether the meat is chilled or unchilled. However, raw meat is easier to handle after chilling and may be held for a few days until convenient to can.

Frozen meat may be canned, but it does not make a high-quality product. If meat has become frozen, do not thaw it out before canning. Cut or saw the frozen meat into uniform strips 1 to 2 inches thick and plunge at once into boiling water. Simmer until the color of raw meat has almost disappeared; then pack and process.

Utensils and Equipment

Utensils for meat canning are preferably of enamelware, aluminum, retinned metal, or stainless metal. Copper and iron utensils may discolor canned meat and should not be used. Also meat must not be allowed to remain in contact with galvanized iron more than 30 minutes, or it may take up harmful quantities of zinc. Wooden utensils or surfaces require special care in cleaning to free them from bacteria. They should be scrubbed with soapy water to remove all grease and then rinsed with boiling water. If used for several days at a stretch they should be disinfected with a hypochlorite solution (calcium, potassium, or sodium hypochlorite) applied after the scrubbing and scalding.

Plain tin cans and glass jars are used for the home canning of meats and poultry. When canned in tin, chicken is more likely than other meats to discolor the cans, and sometimes there is a deposit on the chicken itself. If the directions given here are followed for packing

the chicken hot and leaving proper head space in the containers, this discoloration will be reduced to a minimum. The C-enamel cans used for corn and the R- or sanitary-enamel cans for certain fruits are not suitable for chicken because the fat may cause the enamel to peel off and make the product unattractive although harmless.

In canning meat and poultry the head space is particularly important. If the liquid does not cover the meat it will discolor and lose flavor during storage. In packing containers allow the following head space: Glass jars, one-half inch; No. 1 tin cans, one-fourth inch; No. 2 tin cans, one-fourth inch; No. 3 tin cans, one-half inch.

Pint containers are most suitable for canning meat, and it is suggested that any of these small containers on hand may well be set aside for meat. Do not can meat in jars or tin cans larger than quart size. See table 9 for processing times.

Precooking

When glass jars are used, meats should be precooked in the oven or in water before being packed in the container. A better looking pack results. And since heat penetrates glass slowly the precooking is necessary to shorten the processing time. When tin cans are used the meat may be precooked in either of these ways and packed hot, or it may be packed raw and the cans exhausted before being sealed. The latter method gives a little better flavored product, and the liquid is all meat juice, but it takes more time and stove space. Frying is not recommended as a method of precooking meat for canning, because it makes the meat hard and dry and gives it a disagreeable flavor.

Cut the meat into uniform pieces weighing about

In the oven 1 pound each, and cook in a moderate oven (350° F.) until the red or pink color of the raw meat almost disappears at the center. This requires about 30 to 40 minutes. Cut the meat so that there are two or more pieces to each container, pack at once closely, cover with the pan drippings or with boiling water, leaving proper head space, and process immediately.

Chicken is handled in this same way except it needs only about 20 to 30 minutes because of the smaller size of the pieces. This is the best way to precook chicken for canning in glass.

Cut the meat into uniform pieces weighing about

In water 1 pound and place in boiling water. Partly cover the kettle and simmer for 12 to 20 minutes, until the color of the raw meat has almost disappeared from the center of the pieces. At this stage the meat has lost about one-third of its original weight because of the juice that has cooked out. At once cut the meat into smaller pieces, pack into the containers, and press the meat down closely with a wooden mallet or pestle. Cover with the broth, leaving proper head space, and process immediately.

This method, commonly referred to as parboiling, is the quickest way to precook a large quantity of meat. It is also used with chicken except that the time is only about 8 to 10 minutes.

Pack two or more pieces of meat into each can, and place the filled but open cans in a bath of boiling water that comes to within $1\frac{1}{2}$ to 2 inches of the top of the can. Cover the bath to hold in steam and heat, being careful that water from the bath does not bubble into the cans. Continue heating until the meat in all the cans is steaming hot, or 170° F., at the center of the cans, and has practically lost the color of raw meat. If no thermometer is available, turn out the meat from a few of the cans to be sure it is heated through. The time required is about 40 to 50 minutes for No. 2 cans of beef or pork and somewhat less for chicken. Press the meat down and be sure that it is covered with broth and that there is proper head space in the cans. Seal at once and process immediately.

Packing and Processing

Salt is added to cans of meat as follows: One-half teaspoon to a pint jar, three-fourths teaspoon to a No. 2 can, and 1 teaspoon to a quart jar or No. 3 can. When tin cans are used, place the salt in the cans before packing them with meat. If the salt is placed on top of the meat, the lids sometimes rust.

Beef, fresh

Select cuts of beef commonly used for roasts or steaks—round, rump, loin, rib, and chuck. Cuts that contain more connective tissue and bone may be canned as stew meat, hamburger, or other products utilizing small pieces or used in soups. Wipe the meat with a damp cloth, remove the bone and gristle, and leave only enough fat to give flavor. If using glass jars, precook in the oven or in water (pp. 39 and 40), pack into containers, add salt, cover with broth, and process as directed in table 9. If using tin cans, follow the same method, or pack the meat raw and exhaust the cans (pp. 39 and 40).

Beef, ground (hamburger)

Prepare hamburger by grinding the meat through a plate with $\frac{1}{8}$ -inch holes. Add 1 cup of salt for each 25 pounds of meat and mix well. Pack the cold meat tightly into tin cans and exhaust the cans until the meat is steaming hot (pp. 39 and 40). If canning in glass jars, form the meat into cakes, precook in the oven, pack hot, and cover with broth. Process immediately as directed in table 9.

Beef, hash, and stew meat

One way of utilizing small pieces of meat is to can it for combining later with potato in hash. Cut or chop the meat into uniformly small pieces. Add sufficient water to cover, bring to simmering, and

cook for several minutes. Pack hot and process as directed in table 9.

For use in making stew, cut the meat into 1-inch cubes, cover with boiling water or broth, and simmer until the meat is shrunken and heated through. This requires about 8 to 10 minutes. The color of raw meat will have almost disappeared from the center of the pieces. Pack the drained meat closely into containers, add salt, and cover with boiling concentrated broth. Process immediately as directed in table 9.

Beef, heart and tongue

The tongue and heart are generally used as fresh meat, but they may be canned as follows: Wash the tongue, drop into boiling water and simmer for about 45 minutes, or until the skin can be removed. Skin and cut into pieces that will fit into the containers. Reheat to simmering in broth, pack into containers; add salt and broth to cover. Process as directed in table 9.

Wash the hearts, remove the thick connective tissue, and cut into pieces suitable for packing. Drop into boiling water and simmer for 15 to 20 minutes. Pack at once; add salt and broth to cover. Process as directed in table 9.

Beef stew with vegetables

Sprinkle the stew meat with salt and white pepper and dredge with flour. Brown the meat in hot beef fat; then add a small quantity of chopped onion and brown. Remove from the heat. Prepare a mixture of tomato pulp and equal parts of diced carrots, diced turnips, and diced potatoes. Add hot water and bring to boiling. Add the meat mixture and more salt and white pepper if needed. Pack hot and process as directed in table 9.

Beef, corned

Wash the corned beef, cover with cold water, bring to the boiling point, and drain. Cover the meat again with cold water, bring to the boiling point, then lower the heat and simmer until the meat is thoroughly heated through. Remove the meat from the broth a piece at a time, and while it is still hot cut into smaller pieces, and pack into the containers. Season the broth as desired, with bay leaves, cloves, or nutmeg. Sometimes gelatin softened in a little cold water is added. Pour boiling broth over the meat to cover. Process as directed in table 9.

Chicken and other poultry

For canning select plump, 2-year-old hens, preferably when they are culled from the flock during July and August. Young birds may be canned, but the texture and flavor of the meat is not so good as that from mature birds.

Dress the chickens as for cooking, and take particular care not to break the gall bladder because the meat is then unfit for canning.

Also remove the lungs, kidneys, and eggs. Cut the chicken into the usual sized pieces for serving and separate into three piles—the meaty pieces (breasts, thighs, legs, and upper-wing joints), the bony pieces (backs, wings, necks, and perhaps the feet after they have been skinned), and the giblets.

The giblets should not be canned with the other meat as they will flavor and discolor it. Also it is better to can the livers alone, and the gizzards and hearts together. Remove the chicken skin or not as desired, and trim off lumps of fat. Too much fat makes chicken difficult to process.

Make broth with the bony pieces. Cover with lightly salted cold water, simmer until the meat is tender, and drain off the broth to use as the liquid in canning the meaty pieces. Strip the meat from the bones and can as small pieces or use in making sandwich spread.

If desired add 5 tablespoons of granulated gelatin to each quart of broth. Moisten the gelatin first with a little of the cold liquid and dissolve in the hot broth.

The meaty pieces of chicken may be canned either with or without the bone. With the bone the product is better flavored. Precook in the oven or in water and pack hot as described on pages 39 and 40. Or exhaust in tin cans until steaming hot (p. 40). Add salt according to the size of the container (p. 40), and process as directed in table 9.

Precook giblets in water and pack hot, or exhaust in tin cans, and process as directed in table 9.

Chicken sandwich spread

This is a good way to utilize the small bits of meat stripped from the bony pieces.

4 pounds cooked chicken, chopped or ground.	1 quart chicken broth.
1½ pounds olives, chopped.	½ teaspoon curry powder.
1 pound pimientos, cut in small pieces.	1 teaspoon ground mace.
	1 teaspoon ground mustard.
	Salt and white pepper, to taste.

Combine all of the ingredients, stir, and heat gradually to simmering. Pack hot and process immediately as directed in table 9.

Chicken-liver paste

Chicken livers may be made into a paste for sandwiches. Simmer the livers for 10 minutes and drain. Mash with a fork and remove any stringy tissue. Then add a small quantity of finely chopped olives, mayonnaise, and dashes of tabasco sauce and paprika. Stir while heating carefully to prevent scorching. Pack hot and process as directed in table 9.

Chicken-gumbo soup

Prepare chicken-gumbo soup by any tested recipe. Pack hot into the containers and process according to the directions given in table 9.

Chile con carne

Use 2 pounds of chili beans or some other pink or red variety. Pick over the beans, wash, and soak overnight in a cool place. Remove thick connective tissue from 5 pounds of lean beef, or beef and pork mixed, and grind coarsely or chop. Add a little chopped garlic, 3 to 5 tablespoons of chili powder, 3 tablespoons of salt, and one-half cup of wheat flour, and mix well with the meat. Cook the mixture in 1 cup hot beef fat until the red color of the meat disappears. Add 2 quarts hot water, cover, and simmer for about 10 minutes. Drain the beans and blanch for 5 minutes in boiling water. Drain. Fill cans or jars about one-third full of the hot beans. Add the hot meat mixture to about seven-eighths of capacity, then hot water to fill. Process immediately as directed in table 9.

Lamb and Mutton

Select the fleshy parts and follow the same method as for beef, page 40. Can the smaller pieces as stew meat (p. 41).

Liver paste

Beef, calf, lamb, or hog liver may be used in this way.

3 pounds liver.	1 medium sized onion, chopped.
1½ pounds fat fresh pork.	3 eggs.
2 tablespoons salt.	6 tablespoons fine dry bread
1 teaspoon white pepper.	crumbs.
½ teaspoon ground cloves.	½ cup water.

Wash the liver thoroughly and remove veins and membranes. Grind the raw liver and pork twice through a plate with ⅛-inch holes, to make it very smooth. Add the seasonings. Beat the eggs well and combine with the bread crumbs and water. Stir all ingredients together until well mixed. Pack into No. 2 cans leaving 1 inch of head space and exhaust until the paste is heated through to the center of the cans. This requires about 40 to 50 minutes (p. 40). Remove some of the paste or add a little hot water, if necessary, so that the cans have the proper head space before sealing. Process as directed in table 9.

Pork and beans

Pick over white navy beans, wash, and soak in a cool place for about 16 hours, or overnight. Drain. Prepare liquid to cover the beans, using the proportion of 1 quart of water, 1 tablespoon of salt, and 1 tablespoon of sugar (or molasses) to each pound of dry beans. Or

prepare an equal quantity of tomato sauce, using 3 cups of tomato pulp to 1 cup of water. Add ground spices, cayenne pepper, and chopped garlic or onion, as desired. Cook until thick.

Blanch the beans for 2 minutes in boiling water, and drain. Place small pieces of salt pork in a bean pot or other container for baking. Add the beans and additional pieces of salt pork, and cover with the prepared liquid or tomato sauce. Cover the pot and cook the beans in a slow oven (about 250° F.) for 1½ hours. Remove the lid and combine all of the ingredients, stir, and heat gradually to simmering. Pack hot and process immediately as directed in table 9.

Pork, fresh

The cuts of pork usually canned are the following: Loin; meat from spareribs; head, tongue, and heart in headcheese; loin and lean trimmings in sausage; and liver in liver paste. While the ham and shoulder may be canned, they are generally preserved by curing.

Remove excess fat from the meat to be canned and precook by any of the methods described on page 39. Pack hot and process as directed in table 9.

Pork, headcheese

Headcheese may be made from a hog's head, tongue, and heart, according to any good recipe but omitting the sage. Pack the headcheese hot into containers and process as directed in table 9. It is better to use tin cans so that the product can be removed in a single piece.

Pork sausage

Follow any tested formula for preparing the sausage, but omit the sage for that gives the sausage a bitter flavor after processing. See that the seasonings and meat are well mixed together.

If using tin cans, pack the raw sausage closely into the No. 2 size and exhaust the cans until the sausage is steaming hot, as directed on page 40. This requires 40 to 50 minutes. Process as directed in table 9. Before opening a can heat for a few minutes in boiling water, then slip the contents of the can out in one piece, slice into rounds, and reheat in gravy or in an oven.

If glass jars are used, mold the sausage into cakes and precook in a moderate oven (350° F.) for 10 to 15 minutes, or until the cakes are slightly browned and the color of raw meat has almost disappeared. Pack into the jars and cover with the drippings or with hot water. Process as directed in table 9.

Rabbit, domestic

Precook and process in the same way as chicken (table 9).

TABLE 9.—Timetable for processing meats and chicken in the steam pressure canner

At altitudes over 2,000 feet, add 1 pound of pressure for each additional 2,000 feet. Follow the directions given on pages 8, 13, and 18 for operation of canner and removal of jars and cans after processing. Cool tin cans in cold water.

250° F., OR 15 POUNDS PRESSURE

Product	No. 2 can	No. 2½ can	No. 3 can	Pint glass jar	Quart glass jar
	<i>Minutes</i>	<i>Minutes</i>	<i>Minutes</i>	<i>Minutes</i>	<i>Minutes</i>
Beef:					
Fresh.....	85	110	120	85	120
Ground (hamburger).....	90	115	-----	90	120
Hash.....	90	115	-----	90	120
Heart and tongue.....	85	110	120	85	120
Stew meat.....	85	110	120	85	120
Stew with vegetables.....	85	110	120	85	120
Corned.....	85	110	120	85	120
Chicken and other poultry:					
With bone.....	55	65	70	65	75
Boned.....	85	110	120	85	120
Giblets.....	85	-----	-----	85	-----
Sandwich spread.....	{ No. 1, 55	-----	-----	½-pint, 65	-----
	{ No. 2, 90	-----	-----	Pint, 90	-----
Liver paste.....	{ No. 1, 55	-----	-----	½-pint, 65	-----
	{ No. 2, 90	-----	-----	Pint, 90	-----
Lamb and mutton.....	85	110	120	85	120
Liver paste.....	90	-----	-----	90	-----
Pork:					
Fresh.....	85	110	120	85	120
Headcheese.....	90	-----	-----	90	-----
Sausage.....	90	115	-----	90	120
Rabbit domestic.....	85	110	120	85	120
Soups:					
Broth, clear.....	25	30	30	25	30
Broth with rice or barley.....	35	40	40	35	40
Chicken gumbo.....	65	75	80	65	80
Soup stock.....	40	45	45	40	45
Veal.....	85	110	120	85	120

240° F., OR 10 POUNDS PRESSURE

Chile con carne.....	120	135	150	120	150
Pork and beans.....	70	80	85	80	90

Soup stock and broth

Chicken or meat.—Broth containing small pieces of meat and sediment from coagulated proteins is commonly called soup stock. Clear meat broths for canning should be fairly concentrated but avoid prolonged boiling as it will cause loss of flavor. Also, if meat bones are cooked for a long time under pressure to make broth or soup stock, the broth will have a disagreeable gluey flavor. Remove excess fat from broth or soup stock before canning.

Rice or barley may be added to the broth in the proportion of 1 cup of the uncooked cereal to each gallon of clear meat broth. Wash the cereal, boil for 15 minutes in salted water, drain, and rinse with cold water. Bring the meat broth to the boiling point and add the cereal. Season as desired. Process as directed in table 9.

Veal

Same as beef, fresh.

BEFORE EATING, INSPECT ALL CANNED FOOD

All foods should be inspected before being prepared for the table. Canned food is no exception to this rule. If there is any evidence of spoilage, the food should be discarded and nonacid vegetables and meats should be burned.

Inspect the can or jar before opening. In tin cans both ends should be flat and curved slightly inward. Neither end should bulge or snap back when pressed. All seams should be tight and clean, with no traces of leaks. In glass jars there should be no bulging of the rubber and no signs of leakage.

When the container is opened there should not be any sudden outburst of air or spurting of liquid. The odor should be characteristic of the product. Any different odor probably indicates spoilage. The inside of tin cans should be smooth and clean or well-lacquered and not markedly corroded. Food may be left in a tin can after it is opened, provided it is covered and kept cold just as any other cooked food. Acid foods and tomatoes may dissolve minute quantities of iron from the can and acquire a slightly metallic flavor, but this is harmless. The purple that develops in red fruits and sometimes in peaches and pears canned in tin, is merely a change in the color pigments and is also harmless.

The broth over canned meats and chicken may or may not be jellied, depending on the quantity of connective tissue and cartilage in the meat. If it is liquid, this is no indication of spoilage.

Never taste to discover spoilage. When spoilage has occurred in nonacid foods there is always a possibility that even a taste may cause serious illness. For this reason it is good practice to boil all canned nonacid vegetables before using them. The processes recom-

mended for meats are much longer than those for vegetables and should destroy all dangerous bacteria.

Freezing does not cause canned foods to spoil unless it breaks the seal and permits micro-organisms to enter. All frozen canned foods should therefore be examined for leakage. Sometimes freezing may bulge tin cans and spread the seams enough to permit bacteria to enter and yet not cause leakage. Bulged cans of frozen food, therefore, should be used as promptly as possible if they cannot be kept frozen.

Signs of Spoilage

Foods canned in tin sometimes show the following evidences of spoilage.

Cans that have caved in, or collapsed, on the sides are called buckled cans. This may occur when No. 3 or larger sized cans are cooled too quickly after processing. These large cans should be allowed to remain in the canner until the pressure gage has reached zero to avoid too sudden change of pressure. Cans of smaller sizes when slack-filled sometimes buckle on cooling and break the seams. In this case the food should be put into other cans and reprocessed, or used at once.

Springers are cans with bulged ends. The ends of cans generally become convex, or outwardly curved, during processing because of expansion of the food and the formation of steam. When the cans cool the ends should snap back to a concave, or inwardly curved position. If a can is too full, the ends may not snap back into proper position, and the can is called a springer. Such cans should be marked so they will not be confused with those that become bulged during storage.

When gas is formed within a can it may cause the ends of the can to bulge. For example, some fruits, such as prunes, apples, and some berries, react with the metals of the can, and hydrogen gas is liberated. When this collects, the can may become a "hydrogen swell." In this case the food itself is not affected. However, in several types of food spoilage, gases are produced that cause swelled cans. For this reason bulged ends on a can are regarded as an indication of spoilage. When canned fruits show such a condition, they should be examined for other indications of spoilage. When a can of meat or nonacid vegetables has bulged ends the food in it should be disposed of by burning.

Some of the fruits that react with the metals of the can to produce hydrogen swells may also cause perforations and leaks. These result from the centering of the chemical reaction on a few points. If the can is discovered soon after leaking starts the food may be used, but if the

leakage is not detected until later, fermentation or other types of spoilage may have set in.

Canned foods are likely to develop perforations and hydrogen swells rather quickly if stored in too warm a place; hence cool storage is especially important for canned fruits that react in this way on the metal.

OTHER BULLETINS ON FOOD PRESERVATION

United States Department of Agriculture:

Farmers' Bulletin No. 879, Home Storage of Vegetables.

Farmers' Bulletin No. 1186, Pork on the Farm—Killing, Curing, and Canning.

Farmers' Bulletin No. 1415, Beef on the Farm—Slaughtering, Cutting, Curing.

Farmers' Bulletin No. 1438, Making Fermented Pickles.

Farmers' Bulletin No. 1800, Home-made Jellies, Jams, and Preserves.

Farmers' Bulletin No. 1807, Lamb and Mutton on the Farm.

Farmers' Bulletin No. 1918, Drying Food for Victory Meals.

United States Department of the Interior:

Fish and Wildlife Service, Fishery Investigational Report No. 34, The Home Canning of Fishery Products. 10 cents per copy from Superintendent of Documents, Washington, D. C.